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ASSIGNMENT BOOKLET 4B

SCN1270 Science 10
Module 4: Section 2 Assignment

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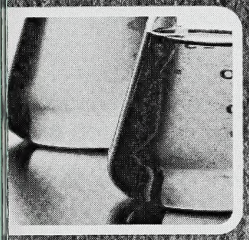
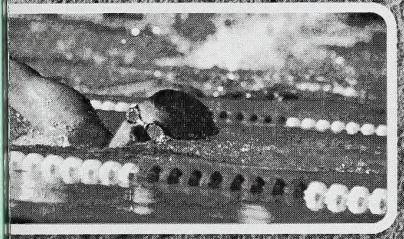
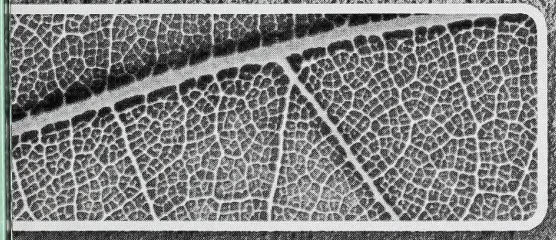
SCIENCE 10

Module 4

Energy Flow in Global Systems







Assignment Booklet 4B

Learning Technologies Branch

Alberta EDUCATION

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Summary

	Total Possible Marks	Your Mark
Section 2 Assignment	64	

Teacher's Comments

Science 10
Module 4: Energy Flow in Global Systems
Assignment Booklet 4B
Section 2 Assignment
Learning Technologies Branch
ISBN 0-7741-2763-5

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The Learning Technologies Branch acknowledges with appreciation the Alberta Distance Learning Centre and Pembina Hills Regional Division No. 7 for their review of this Assignment Booklet.

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Students	✓
Teachers	✓
Administrators	
Home Instructors	
General Public	
Other	

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- Alberta Education, **http://www.education.gov.ab.ca**
- Learning Technologies Branch, **http://www.education.gov.ab.ca/ltb**
- Learning Resources Centre, **http://www.lrc.education.gov.ab.ca**

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ASSIGNMENT BOOKLET 4B
SCIENCE 10: MODULE 4
SECTION 2 ASSIGNMENT

This Assignment Booklet is worth 64 marks out of the total 135 marks for the assignments in Module 4. The value of each assignment and each question is stated in the left margin.

Read all parts of your assignment carefully and record your answers in the appropriate places. If you have difficulty with an assignment, go back to your Student Module Booklet and review the appropriate lesson. Be sure to proofread your answers carefully before submitting your Assignment Booklet.

Section 2 Assignment: Energy Transfer in the Biosphere

64

For questions 1 to 8, read each question carefully. Decide which of the choices BEST completes the statement or answers the question. Place your answer in the blank space given.

(1) _____ 1. Which list correctly orders the forms of radiant energy by increasing wavelength?

A. infrared light, radio waves, ultraviolet light, visible light
B. visible light, ultraviolet light, radio waves, infrared light
C. radio waves, visible light, ultraviolet light, infrared light
D. radio waves, infrared light, visible light, ultraviolet light

(1) _____ 2. The word equation representing the net rediation budget value is

net radiation budget = incoming radiation – outgoing radiation

Which change would most likely result in an increase in the net radiation budget?

A. The polar ice caps increased in area.
B. Earth moved further from the Sun.
C. The level of atmospheric dust increased.
D. The Sun began giving off more radiant energy.

(1) _____ 3. The net radiation budget would increase as a result of a rise in atmospheric levels of

A. methane
B. water vapour
C. nitrous oxide
D. all of the above

(1) _____ 4. Of the solar energy that falls on Earth, what percentage do land and oceans absorb?

A. more than 50%
B. approximately 30%
C. approximately 19%
D. less than 6%

(1) _____ 5. The natural greenhouse effect is important to life on Earth because

A. Earth would be too hot without the natural greenhouse effect
B. Earth would be too cold without the natural greenhouse effect
C. there would be no atmosphere without the natural greenhouse effect
D. all of the above

(1) _____ 6. Which greenhouse gas is the main contributor to the natural greenhouse effect?

A. methane
B. water vapour
C. carbon dioxide
D. nitrous oxide (dinitrogen dioxide)

(1) _____ 7. Which region has the greatest deficit in its net radiation budget?

A. Arctic region
B. Equatorial region
C. Atlantic region
D. Appalachian region

(1) _____ 8. The average temperature for the year in Mexico City, Mexico, is 16.1°C. The average temperature for the year in Regina, Saskatchewan, is 2.8°C. What is one possible explanation for this difference in average temperature?

A. Mexico City is situated on a river.
B. Mexico City is closer to the equator.
C. Regina is near an ocean.
D. Regina is at a higher elevation.

(1) 9. Earth's axis is tilted _____ degrees from the perpendicular of the plane of its orbit.

(2) 10. Calgary receives 7 h 54 min of hours of daylight (sunrise to sunset) on December 22. On the same day, Edmonton receives 7 h 28 min hours of daylight. Explain why the number of hours of daylight is less in Edmonton than in Calgary on December 22.

_____

_____

_____

(2) 11. Suppose Earth's angle of inclination was 0°C rather than its actual value. Explain how insolation would change over the months of the year in High Level, Alberta.

_____

_____

_____

(2) 12. When solar energy is absorbed by Earth's surface, the surface is warmed. Because the surface is warmed, it radiates energy. Explain why the energy radiated from Earth's surface is not all lost into space.

_____

_____

13. Kerry was investigating how the angle of incidence of radiant energy on a surface affects the rate of temperature rise of the surface. A paper pocket holding a thermometer was placed near a lamp. The paper pocket was then placed at various angles so that the angle of incidence of the radiant energy varied. Kerry made sure the distance to the lamp was the same for each of his trials.

The following table shows the data recorded by Kerry.

HEATING AT VARIOUS ANGLES OF INCIDENCE

Length of Exposure to Light (min)	Temperature of Probe (°C)		
	AI* = 0°	AI* = 45°	AI* = 90°
0	22.0	22.0	22.0
5	30.5	26.5	22.0
10	34.5	28.5	22.5
15	36.0	30.0	22.5

*AI: angle of incidence

(1) a. What is the manipulated variable?

_____

(1) b. What is the responding variable?

_____

(1) c. Identify one controlled variable.

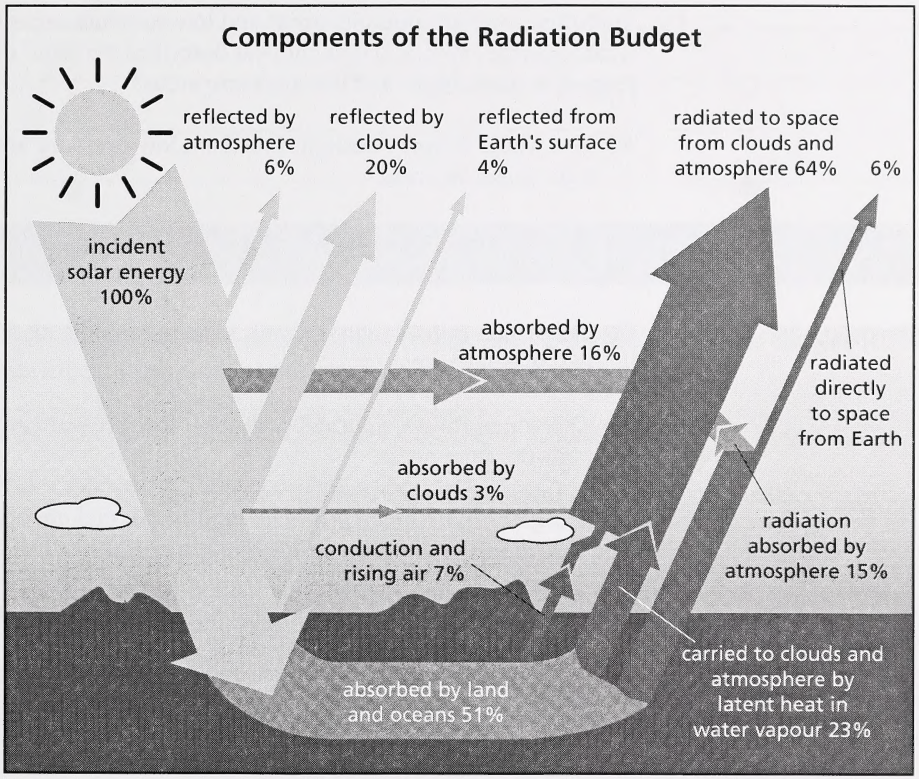
_____

(1) d. Using the data, describe the relation between the angle of incidence and the rate of temperature change.

_____

_____

(4) 14. Use the information in the following diagram to determine the net radiation budget for Earth. **Show your work.**


Components of the Radiation Budget
reflected by atmosphere 6%
reflected by clouds 20%
reflected from Earth's surface 4%
radiated to space from clouds and atmosphere 64%
6%
incident solar energy 100%
absorbed by atmosphere 16%
radiated directly to space from Earth
absorbed by clouds 3%
radiation absorbed by atmosphere 15%
conduction and rising air 7%
carried to clouds and atmosphere by latent heat in water vapour 23%
absorbed by land and oceans 51%

Return to page 44 of the Student Module Booklet and begin Section 2: Lesson 2.

Read question 15 carefully. Decide which of the choices BEST answers the question. Place your answer in the blank space given.

(1) _____ 15. You often see high-pressure areas and low-pressure areas indicated on weather maps. Which statement best describes the wind direction with respect to these high- and low-pressure areas?

A. The winds follow a straight line from low-pressure areas to high-pressure areas.

B. The winds follow a straight line from high-pressure areas to low-pressure areas.

C. The winds follow a curved path from high-pressure areas to low-pressure areas.

D. The winds follow a curved path from low-pressure areas to high-pressure areas.

16. Match each description with the appropriate type of thermal energy transfer from the following list. Place your answer in the blank space given.

i. radiation ii. convection iii. conduction

(½) _____ a. requires direct contact between substances at different temperatures

(½) _____ b. based on currents flowing in fluids

(2) 17. Fill in the blanks so the paragraph describes the movement of thermal energy in the atmosphere in response to net radiation budgets of different regions.

Thermal energy is transferred by _____ . The thermal energy transfer is from areas having a net radiation budget _____ to areas having a net radiation budget deficit.

(2) 18. Describe the Coriolis effect on the large-scale movement of air in the atmosphere.

_____

_____

_____

_____

_____

(2) 19. Jet streams are bands of fast-moving air. Explain why jet streams have such a high velocity.

_____

_____

_____

_____

Return to page 50 of the Student Module Booklet and begin Section 2: Lesson 3.

For questions 20 to 24, read each question carefully. Decide which of the choices BEST answers the question. Place your answer in the blank space given.

(1) _____ 20. What is the specific heat capacity of a substance?

A. the amount of energy needed to melt 1 g of the substance

B. the amount of energy needed to dissolve 1 g of the substance

C. the amount of energy needed to raise the temperature of 1 g of a substance 1°C

D. the amount of energy that flows between two points of a substance where the points are kept at a temperature difference of 1°C

(1) _____ 21. What is the thermal energy needed to completely melt 9.60 mol of ice at 0.0°C?

A. 19.2 kJ
B. 31.4 kJ
C. 57.7 kJ
D. 94.0 kJ

(1) _____ 22. What is the thermal energy needed to completely vaporize 18.02 g of water at 100°C?

A. 6.01 kJ
B. 40.7 kJ
C. 6.01×10^3 kJ
D. 4.07×10^4 kJ

(1) _____ 23. A mass of water dropped in temperature by 25.1°C. It gave off 5240.0 J of energy in the process. Approximately how many grams of water were involved?

A. 40 g
B. 45 g
C. 50 g
D. 55 g

Use the following table to answer question 24.

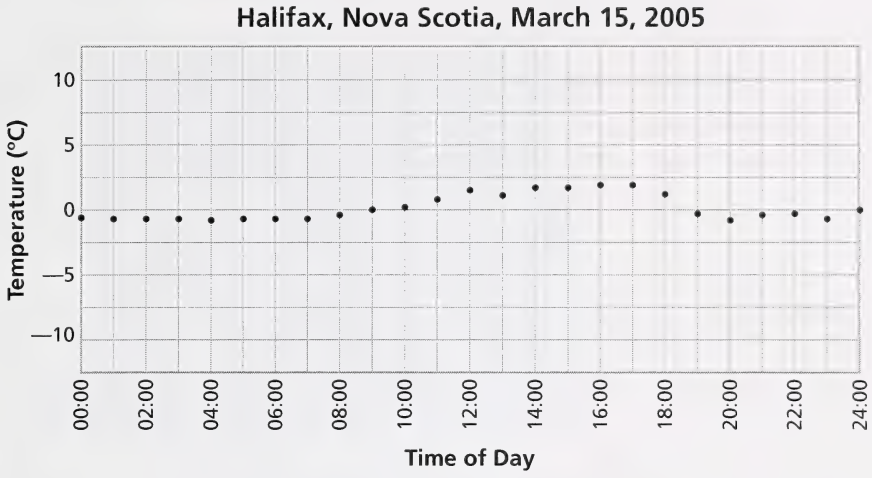
SPECIFIC HEAT CAPACITIES OF SOME SUBSTANCES

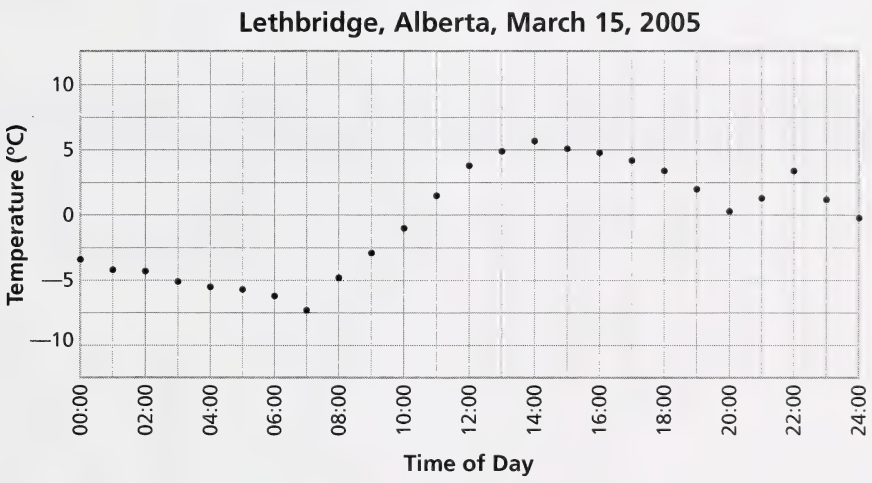
Substance	Specific Heat Capacity c (J/g•°C)
dry soil	0.84
granite	0.79
water	4.19
wet soil	1.48

(1) _____ 24. Which list of the four substances is in order from quickest to heat/cool to slowest to heat/cool?

A. dry soil, granite, wet soil, water
B. granite, dry soil, wet soil, water
C. water, wet soil, granite, dry soil
D. water, wet soil, dry soil, granite

25. Examine the following graphs closely.





(2) a. How much did the temperature vary in each city?

_____

_____

(2) b. For the month of March in Lethbridge, the average high was 6.0°C and the average low was −6.5°C. For Halifax, the average high was 3.0°C and the average low was −5.8°C. Explain why the temperature changes more in one city than in the other.

_____

_____

26. To determine the specific heat capacity of copper, Alyssa performed an investigation by which she dropped a heated piece of copper into a calorimeter. Some of the data Alyssa recorded is given in the following table.

Type of Metal	copper
Mass of Metal	104 g
Initial Temperature of Metal	98.9°C
Mass of Water and Calorimeter	65.0 g
Mass of Empty Calorimeter	2.0 g
Initial Temperature of Water	22.0°C
Final Temperature of Water	33.5°C

(1) a. What was the final temperature of the copper object? Explain your answer.

(1) b. Determine the temperature change, Δt, of the copper object? **Show your work.**

(1) c. Determine the temperature change, Δt, of the water? **Show your work.**

(2) d. If the specific heat capacity of water is 4.19 J/g•°C, calculate the energy absorbed by the water. **Show your work.**

(2) e. Determine the experimental specific heat capacity of the copper. **Show your work.**

(3) 27. Explain how phase changes of water are involved in the transfer of thermal energy in the hydrologic cycle.

_____

_____

_____

_____

Return to page 75 of the Student Module Booklet and begin Section 2: Lesson 4.

For questions 28 to 30, read each question carefully. Decide which of the choices BEST answers the question. Place your answer in the blank space provided.

(1) _____ 28. Which biome has the highest net radiation budget value?

A. deciduous forest
B. rain forest
C. tundra
D. taiga

(1) _____ 29. Which biome has the least precipitation?

A. rain forest
B. grassland
C. tundra
D. taiga

(1) _____ 30. Which two biomes are found in Alberta?

A. deciduous forest and grassland
B. grassland and taiga
C. rain forest and taiga
D. taiga and tundra

31. For each biome, match the plant and animal from the following lists that are most likely found in that biome.

Plants	Animals
• broad-leafed trees	• dingo dog
• succulent plants	• ptarmigans
• lichens	• moose
• air plants	• timber wolves
• grasses	• parrots
• cone-bearing evergreens	• hyenas

(1) a. tundra: _____

(1) b. taiga: _____

(1) c. deciduous forest: _____

(1) d. grasslands: _____

(1) e. rain forest: _____

(1) f. desert: _____

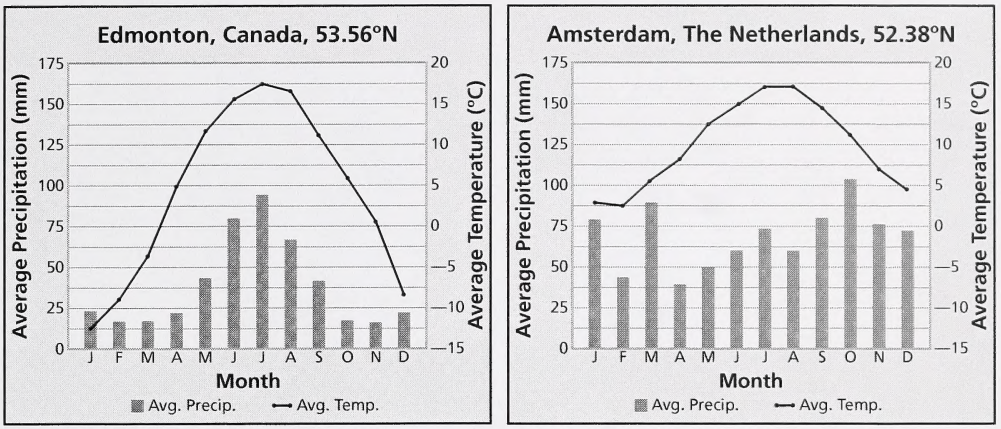
Return to page 81 of the Student Module Booklet and begin Section 2: Lesson 5.

Read question 32 carefully. Decide which of the choices BEST answers the question. Place your answer in the blank space given.

(1) _____ 32. Which list consists of four factors that play a role in determining climate?

A. altitude, insolation, ocean currents, soil type
B. insolation, mountain ranges, ocean currents, soil type
C. insolation, latitude, mean June temperature, ocean currents
D. global winds, insolation, large bodies of water, ocean currents

33. Examine to the following climatographs closely.



(1) a. In which location does the temperature vary the most?

_____

(1) b. Which location receives less precipitation?

_____

(2) c. Edmonton and Amsterdam are roughly at the same latitude, yet their climates are different. In your own words, explain why their climates are different. You may need to check the location of each city on a map of the world.

_____

_____

_____

_____

Submit your completed Assignment Booklet 4B to your teacher for assessment. Then return to page 90 of the Student Module Booklet and begin Section 3.

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